

WHAT IS CLAIMED IS:

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1 1. An implantable hearing device comprising:
2 a transducer which produces vibrations in response
3 to an electrical signal; and
4 a connecting member having a first end connected to
5 the transducer and a second end connectable to a component of
6 a human ear, wherein the transducer and the component of a
7 human ear are elastically coupled by the connecting member.

1 2. The apparatus of claim 1, wherein said
2 connecting member comprises a resilient biasing mechanism.

1 3. The apparatus of claim 1, wherein said
2 connecting member comprises a urethane strip.

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1 4. An implantable hearing device, which is coupled
2 between a tympanic membrane and an oval window of an ear of a
3 human subject, comprising:

4 an amplifier;
5 a first transducer electrically coupled to said
6 amplifier for converting mechanical vibrations to electrical
7 signals;

8 a second transducer electrically coupled to said
9 amplifier for converting electrical signals to mechanical
10 vibrations;

11 a first connecting member having a first end
12 connected to the first transducer and a second end connected
13 to the tympanic membrane, wherein said first transducer and
14 said tympanic membrane are elastically coupled by said first
15 connecting member;

16 a second connecting member having a first end
17 connected to said second transducer and a second end connected
18 to said oval window, wherein said second transducer and said
19 oval window are elastically coupled by said second connecting
20 member.

21 4. The apparatus of claim ~~3~~³, wherein said first
22 connecting member creates a tensile force between the tympanic
23 membrane to said first transducer when coupled therebetween.

1 5. The apparatus of claim ~~4~~³, wherein said second
2 connecting member creates a tensile force between said second
3 transducer to the oval window when coupled therebetween.

1 7. The apparatus of claim 4, wherein said first
2 and said second connecting members each comprise a resilient
3 biasing mechanism.

1 8. The apparatus of claim 4, wherein said first
2 and said second connecting members each comprise a urethane
3 strip.

1 9. The apparatus of claim 4, wherein said first
2 and said second connecting members each comprise at least one
3 set of angled bends.

1 10. An implantable hearing device connectable to a
2 component of an ear of a human subject, comprising:

3 a hearing device for improving hearing of the human
4 subject; and

5 means for elastically coupling said hearing device
6 to the component of the ear.

1 11. The apparatus of claim 10, wherein said means
2 for elastically coupling creates a tensile force between said
3 implantable hearing device and the component of the ear.

1 12. The apparatus of claim 10, wherein said means
2 comprises a resilient biasing mechanism.

1 13. The apparatus of claim 10, wherein said means
2 comprises a urethane strip.

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3 14. A method of improving hearing in a human
4 subject comprising:

5 implanting an implantable hearing device into a
6 mastoid bone of the human subject; and

7 elastically coupling said implantable hearing device
8 to a vibratory component of the ear using a connecting member.

Sub A 1 15. A method of improving hearing in a human
2 subject, an ear of the human subject having a tympanic
3 membrane and an oval window, comprising:

4 implanting an implantable hearing device in a
5 mastoid bone of the human subject, said implantable hearing
6 device comprising

7 (a) an amplifier,

8 (b) a first transducer electrically coupled to
9 said amplifier, and

10 (c) a second transducer electrically coupled
11 to said amplifier;

12 elastically coupling the tympanic membrane and said
13 first transducer using a first compliant connecting member;
14 and

15 elastically coupling said second transducer and the
16 oval window using a second compliant connecting member.

1 16. A method of manufacturing a hearing device,
2 comprising:

3 providing an amplifier;

4 electrically coupling a first transducer to said
5 amplifier;

6 electrically coupling a second transducer to said
7 amplifier;

8 mechanically coupling a first compliant connecting
9 member to said first transducer; and

10 mechanically coupling a second compliant connecting
11 member to said second transducer.

1 17. The method of claim 16, wherein said first and
2 said second compliant connecting members each create a tensile
3 force.

1 18. The method of claim 16, wherein said first and
2 said second compliant connecting members each comprise a
3 spring.

1 19. The method of claim 16, wherein said first and
2 said second compliant connecting members each comprise a
3 urethane strip.

1 20. In an implantable hearing device of the type
2 coupled to a component of an ear of a human subject, the
3 improvement comprising:

4 a connecting member adapted to elastically couple
5 the implantable hearing device to the component of the ear.

1 21. In an implantable hearing device adapted to be
2 coupled between a tympanic membrane and an oval window of an
3 ear of a human subject and having an amplifier, a first
4 transducer electrically coupled to the amplifier, and a second
5 transducer electrically coupled to the amplifier, the
6 improvement comprising:

7 a first connecting member adapted to elastically
8 couple the tympanic membrane to said first transducer; and

9 a second connecting member adapted to elastically
10 couple said second transducer to the oval window.

1 22. In an implantable hearing device adapted to
2 being coupled to a component of the middle ear of a human
3 subject, comprising an electromagnetic unit having a
4 diaphragm, the improvement comprising:

5 a connecting member adapted to elastically couple a
6 component of the middle ear to said diaphragm.

13.

28. The improved hearing device of claim 22,

2 wherein the connecting member is adapted to be coupled to the
3 diaphragm and the structure of the middle ear using magnetism.

14.

29. The improved hearing device of claim 22,

2 wherein the implantable device is hermetically sealed.

15.

29. An implantable hearing device of the type
2 coupled to one or more ossicles of an inner ear of a human
3 subject, comprising:

4 a housing;

5 an electromagnetic unit having a magnet disposed
6 inside said housing and a coil surrounding a portion of said
7 housing;

8 a diaphragm mechanically coupled to said
9 electromagnetic unit, wherein motion of the diaphragm is
10 proportional to a signal applied to said electromagnetic unit;
11 and

12 a connecting member adapted to elastically couple
13 said diaphragm to the one or more ossicles of the human ear.

16.

29. The improved hearing device of claim 25,

2 wherein the implantable hearing device is hermetically sealed.

17.

29. A method of improving hearing in a human
2 subject, an ear of the human subject having a middle ear
3 structure, comprising:

4 implanting an implantable hearing device in a
5 mastoid bone of the human subject, said implantable hearing
6 device comprising:

7 an electromagnetic unit having a diaphragm
8 mechanically driven by said electromagnetic unit; and

9 elastically coupling said diaphragm and a component
10 of the middle ear structure using a first connecting member.

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24

1 28. The method of claim 27, wherein the implantable
2 hearing device is hermetically sealed.

1 29. A method of manufacturing a hearing device,
2 comprising:

3 providing an electromagnetic unit comprising:
4 a housing;
5 a magnet disposed inside said housing;
6 a coil surrounding a portion of said housing
7 a diaphragm mechanically coupled to said
8 magnet, wherein motion of the diaphragm is substantially
9 proportional to a signal applied to said electromagnetic unit;
10 and

11 mechanically coupling a connecting member to said
12 diaphragm.

1 30. The method of claim 29, further comprising
2 encapsulating the electromagnetic unit such that the
3 electromagnetic unit is hermetically sealed.

1 31. An implantable hearing device adapted to being
2 coupled to one or more ossicles of an inner ear of a human
3 subject, comprising:

4 a coil;

5 a compliant connecting member adapted to elastically
6 couple said coil to a magnet, the magnet being coupled to the
7 one or more ossicles of the human ear.

1 32. The hearing device of claim 31, wherein the
2 compliant connecting member comprises a keeper/spring device.

1 33. A method of improving hearing in a human
2 subject, an ear of the human subject having a middle ear
3 structure, comprising:

4 implanting a magnet on a component of the middle ear
5 structure;

6 elastically coupling the magnet to a first portion
7 of a connecting member; and

8 elastically coupling a coil device to a second
9 portion of said connecting member.

1 22 21
34. The method of claim 33, wherein the connecting
2 member comprises a keeper/spring device.

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26